Scaling of Two-Phase Systems Across Gravity Levels, Phase I

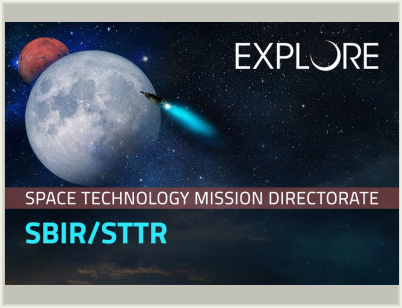
Completed Technology Project (2009 - 2009)

Project Introduction

There is a defined need for long term earth based testing for the development and deployment of two-phase flow systems in reduced-gravity, including lunar gravity, conditions. The proposed study intends to develop a scaling methodology to meet this requirement. A hierarchical two-tiered scaling approach will be used to obtain scaling relations for an entire system (integral scale), individual components of the system and local phenomena. The final product of the Phase I effort will be a rigorous scaling methodology along with important non-dimensional numbers which can be used for developing earth-based systems to study reduced-gravity two-phase systems and/or phenomena. The feasibility of the approach will be demonstrated in Phase I by using data available in literature that has been acquired in reduced-gravity as well as earth based conditions. As part of Phase II a scaled experimental facility will be designed and confirmatory experiments performed.

Anticipated Benefits

The development of the scaling methodology will benefit the experimental design and operation of facilities. The chemical industry where liquid-liquid flows involving small density differences exist which are similar to reduced-gravity conditions due to the reduction in buoyancy can use the scaling methodology applied as part of the proposal to scale experimental facilities. The rapidly growing biomedical field is a prime example where such a method can be applied since multiple scales and different processes exist in any biological system of interest. NASA requires significant advances in the areas of two-phase flow and heat transfer which are essential for thermal management and advanced life support systems for future missions (manned and unmanned) and the establishment of a lunar base. However, uncertainties prevail in the understanding of the operation and behavior of such systems due to the lack of data and limitations of performing experiments. The results of this project will significantly aid and speed up the design, testing and deployment of thermal management systems for heat removal from components and for advanced life support.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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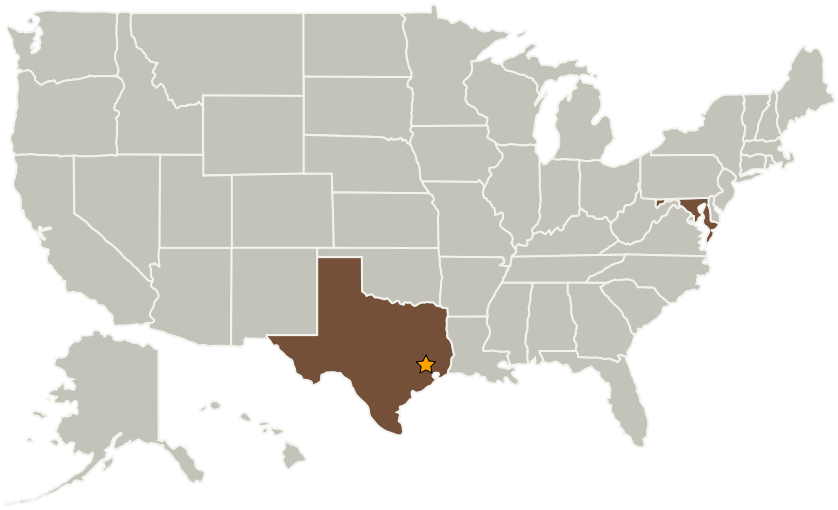
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Energy Research, Inc.	Supporting Organization	Industry	Rockville, Maryland

Primary U.S. Work Locations	
Maryland	Texas

Project Management

Program Director:
Jason L Kessler

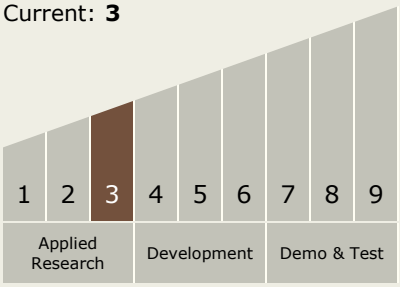
Program Manager:
Carlos Torrez

Project Manager:
John B Mcquillen

Principal Investigator:
Shilp Vasavada

Technology Maturity (TRL)

Start: **3**
Current: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.2 Prevention and Countermeasures